Amendments to the Claims

This listing of claims will replace all prior versions, and listings of claims in the application.

Listing of Claims

Claims 1-18 (Cancelled)

19. (Currently Amended) A reactor comprising

(a) a reaction zone that receives reactants for reaction purposes; and

(b) a heat exchanger in operative contact with the reaction zone so as to receive the reactants exiting the reaction zone for heat exchange purposes, wherein the heat exchanger is formed from a heat exchange panel that includes a plurality of superposed metal printed circuit heat exchange (PCHE) plates bearing fluid flow channels, the channel-bearing PCHE plates being (i) aligned during superposition to define discrete heat exchange pathways for fluids, and (ii) diffusion bonded together.

20. (Previously Presented) A reactor according to claim 19, wherein the reaction zone comprises at least one catalyst bed.

21. (Previously Presented) A reactor according to claim 19, wherein the fluid flow channels are formed by chemically etching the channel-bearing PCHE plates.

22. (Previously Presented) A reactor according to claim 19, wherein the fluid flow channels are formed by hydraulically milling the channel-bearing PCHE plates.

23. (Previously Presented) A reactor according to claim 19, wherein multiple heat exchange panels are embedded within the reaction zone, and wherein a contact face area of the panels is generally equal to a contact face area of the reaction zone.

24. (Previously Presented) A reactor according to claim 19, wherein a plurality of reaction zones are arranged in succession, and wherein a heat exchange panel is arranged between each set of adjacent reaction zones.

25. (Previously Presented) A reactor according to claim 24, wherein at least three reaction zones are arranged in series.

26. (Previously Presented) A reactor according to claim 24, wherein the heat exchange panel has a thickness of up to about 100 mm.

27. (Previously Presented) A reactor according to claim 19, wherein the heat exchange panel includes passages comprising tortuous pathways with one of convolution and zigzags.

28. (Cancelled)

29. (Previously Presented) A reactor according to claim 19, wherein the reaction zone comprises a catalyst bed including a variable form catalyst.

30. (Previously Presented) A reactor according to claim 19, further comprising a screen that restrains catalyst particles from entering the passages of the heat exchanger panel.

31-47. (Cancelled)

48. (Previously Presented) A reactor according to claim 19, wherein the fluid flow channels are formed with a tool.

49. (Previously Presented) A reactor according to claim 48, wherein the fluid flow channels are formed with a water jet.

50. (Previously Presented) A reactor according to claim 19, further comprising:

a reactant fluid inlet;

a reactant fluid outlet;

first and second adjacent catalyst beds each including a catalyst; and

at least two channels that are formed in the PCHE that are separated from one another, the first channel permitting flow of reactant fluid from the first catalyst bed to the second catalyst bed, and the second channel permitting flow of a heat exchange fluid therethrough.

51. (Previously Presented) A reactor according to claim 50, wherein the reactor is a moving bed reactor, and wherein a catalyst outlet is provided adjacent a lower end of each of the catalyst beds such that the catalyst can be urged through the catalyst outlet by gravity and catalyst can be passed through the catalyst inlet.

52. (Previously Presented) A reactor according to claim 50, further comprising an additional heat exchanger in communication with the reactant fluid inlet, the additional heat exchanger containing pre-heat channels.

53. (Previously Presented) A reactor according to claim 50, further comprising a fine mesh that covers ends of the channel adjacent the catalytic beds.

54. (Previously Presented) A reactor according to claim 50, wherein the heat exchanger is formed from plates, the plates being diffusion bonded together.

55. (Previously Presented) A reactor according to claim 50, wherein the heat exchanger includes passages comprising tortuous pathways with at least one of convolutions and zigzags.

56. (Previously Presented) A reactor according to claim 19, wherein the heat exchange pathways are completely separated from one another to prevent contact of the fluids flowing along the respective pathways and to prevent the reactants from reacting within the pathways.

57. (Currently Amended) A reactor comprising:

(a) a reaction zone that receives reactants for reaction purposes; and

(b) a heat exchanger in operative contact with the reaction zone so as to receive reactants subsequently exiting the reaction zone for heat exchange purposes, wherein the heat exchanger is formed from a heat exchange panel that includes a plurality of superposed metal printed circuit heat exchange (PCHE) plates bearing fluid flow channels, the channel-bearing PCHE plates being (i) aligned during superposition to define discrete heat exchange pathways for fluids, and (ii) diffusion bonded together, wherein the fluid flow channels do not extend completely through the plates.

58. (Currently Amended) A method for creating a highly uniform temperature profile for reactants moving through a reactor, the method comprising the steps of:

(a) providing a heat exchanger to receive reactants for heat exchange purposes that is formed from a heat exchange panel that includes a plurality of superposed metal printed circuit heat exchange (PCHE) plates fluid flow channels, the channel-bearing PCHE plates being (i) aligned during superposition to define discrete heat exchange pathways for fluids, and (ii) diffusion bonded together;

(b) positioning the heat exchanger in operative contact with a reaction zone of the reactor that receives reactants for reaction purposes; and

(c) directing the reactants exiting from the reaction zone subsequently through the heat exchanger.

59. (New) A reactor comprising:

(a) a first reaction zone that receives reactants for reaction purposes;

(b) a heat exchanger in operative contact with the first reaction zone so as to receive reactants from the first reaction zone for heat exchange purposes, wherein the heat exchanger is formed from a heat exchange panel that includes a number of superposed metal printed circuit heat exchange (PCHE) plates bearing fluid flow channels that define discrete fluid pathways; and

(c) a second reaction zone in operative contact with the heat exchanger opposite the first reaction zone that receives reactants from the heat exchanger for reaction purposes.